

# INTERNATIONAL STANDARD



Radio interference test on high-voltage insulators

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## CONTENTS

FOREWORD .....	3
INTRODUCTION .....	5
1 Scope .....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 Measurement frequency .....	7
5 Radio noise limits and test voltage.....	7
6 Measuring instruments .....	8
6.1 Standard CISPR measuring apparatus .....	8
6.2 Other measuring apparatus.....	8
7 Measuring circuit.....	8
8 Requirements for test voltage .....	8
9 Atmospheric conditions .....	8
10 Test area .....	9
11 Arrangements of insulators for test .....	9
11.1 Mounting of insulators.....	9
11.2 Conditions of insulators before test .....	10
11.3 Checking and calibration of test circuit .....	10
12 <del>Insulators for</del> Type test.....	10
12.1 Number of insulators.....	10
<del>12.2 String insulator units.....</del>	<del>12</del>
12.2 Voltage application and RI characteristics .....	12
12.3 Acceptance criterion .....	12
<del>13 Procedure for type tests .....</del>	<del>12</del>
13 <del>Procedure for</del> Sample tests .....	12
13.1 General .....	12
13.2 Insulators subjected to sample tests.....	12
13.3 Number of samples.....	13
<del>14.3 Mounting arrangement.....</del>	<del>13</del>
13.4 Test procedure .....	13
13.5 Acceptance criterion .....	13
13.6 Re-test procedure.....	13
14 Test report.....	14
List of comments.....	15

Figure 1 – Schematic representation of the type test procedure: (a) measurement cycle / (b) example of characteristic curve ..... 14

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**A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.**

**This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.**

IEC 60437 has been prepared by IEC technical committee 36: Insulators. It is an International Standard.

This third edition cancels and replaces the second edition published in 1997. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Composite station post and composite hollow core station post insulators have been included;
- b) All paragraphs of Samples test were actualized;
- c) Sample test fast procedure was introduced.

The text of this International Standard is based on the following documents:

Draft	Report on voting
36/585/FDIS	36/591/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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## INTRODUCTION

The first edition of IEC 60437 presented the available information on a radio interference test on high-voltage insulators as a technical report. This allowed further experience in conducting the test and the interpretation of results to be gained.

The second edition incorporated that experience in the form of an International Standard, which gave the recommended procedures for a radio interference test on high-voltage insulators.

This third edition incorporates clarification of test arrangements and the number of insulators to be tested for composite station posts, composite hollow core station posts and hybrid insulators. This edition also incorporates clarification on the fast method for the sample test.

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# RADIO INTERFERENCE TEST ON HIGH-VOLTAGE INSULATORS

## 1 Scope

This International Standard specifies the procedure for a radio interference (RI) test carried out in a laboratory on clean and dry insulators at a frequency of 0,5 MHz or 1 MHz or, alternatively, at other frequencies between 0,5 MHz and 2 MHz.

This document applies to insulators for use on AC or DC overhead power lines and overhead traction lines with a nominal voltage greater than 1 000 V. **1**

In service the RI characteristics of an insulator may be modified by the ambient conditions, particularly rainfall and other moisture, and by pollution. It is not considered feasible to specify reproducible test conditions to simulate a range of ambient conditions. Hence only tests on clean and dry insulators are specified in this document.

NOTE The effects of insulator surface conditions, including pollution, are presented in ~~Amendment 1 of~~ CISPR 18-2:2017, clause 6.3.

## 2 Normative references **2**

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 60050(471):1984, International Electrotechnical Vocabulary (IEV) – Chapter 471: Insulators~~

IEC 60060-1:1989/2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60137:1995/2017, *Insulated bushings for alternating voltages above 1 000 V*

IEC 60168:1994, *Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V*

IEC 60168:1994/AMD1:1997

IEC 60168:1994/AMD2:2000

IEC 60383-1:1993/2023, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 1: Ceramic or glass insulator units for a.c. systems – Definitions, test methods and acceptance criteria*

IEC 60383-2:1993, *Insulators for overhead lines with a nominal voltage above 1 000 V – Part 2: Insulator strings and insulator sets for a.c. systems – Definitions, test methods and acceptance criteria*

IEC 61109:2008, *Insulators for overhead lines – Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria*

IEC 61462:2007, *Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations*



IEC 61952:2008, *Insulators for overhead lines – Composite line post insulators for A.C. systems with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria*

IEC 62231:2006, *Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV – Definitions, test methods and acceptance criteria*

~~CISPR 16-1:1993, Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus~~

CISPR 16-1-1:2019, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 18-2:~~1986~~2017, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits Amendment 1 (1993)*

### 3 Terms and definitions

~~For the purpose of this International Standard, the definitions given in IEC 60050(471) and IEC 60383-1 are applicable.~~

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

### 4 Measurement frequency

~~Measurements of RI characteristics shall be made at a frequency of (0,5 ± 0,05) MHz or (1,0 ± 0,1) MHz or alternatively by agreement between purchaser and manufacturer at other frequencies between 0,5 MHz and 2 MHz.~~

The reference measurement frequency is 0,5 MHz. It is recommended that measurements are made at a frequency of 0,5 MHz ± 10 % **3**. Alternatively, by agreement between purchaser and manufacturer, other frequencies between 0,5 MHz and 2 MHz may be used.

NOTE Although CISPR 18-2 gives the reference measurement frequency for the measurement of RI characteristics as 0,5 MHz, the existing standard practice in some countries is to use 1 MHz or 2 MHz when measuring radio interference characteristics of insulators.

The frequencies of 0,5 MHz or alternatively 1 MHz are preferred because, usually, the level of radio noise at this part of the spectrum is representative of the higher levels and also because 0,5 MHz lies between the low and medium frequency radio broadcast bands.

The RI characteristics of insulators do not normally affect television broadcasts.

### 5 Radio noise limits and test voltage

This document does not specify a limiting value for the radio interference characteristic of insulators or the test voltage.

When RI tests are required, the relevant values, ~~depending on product or national regulations or specifications,~~ shall be found in the relevant IEC standard or shall be agreed between the purchaser and manufacturer.

NOTE Guidance for establishing limit values is given in CISPR 18-2:2017, ~~Amendment 1.~~

## 6 Measuring instruments

### 6.1 Standard CISPR measuring apparatus

Unless otherwise agreed, the standard CISPR measuring apparatus, as specified in CISPR 16-1-1, shall be used for all measurements of RI characteristics of insulators.

### 6.2 Other measuring apparatus

By agreement between the purchaser and manufacturer measuring apparatus differing from the CISPR standard measuring apparatus may be used provided that conversion of the measurements to quasi peak values is possible.

## 7 Measuring circuit

Laboratory measurements of radio noise shall be made by measuring the conducted quantities, either current or voltage.

The relevant measuring circuits are specified in CISPR 18-2.

The basic test circuit is shown in Figure 4 of CISPR 18-2:2017, and a practical form of standard test circuit in Figure 5. For DC insulators tests, H.V. transformer mentioned on both figures shall be a DC voltage generator **4**. Depending on the distance between the measuring set and the test circuit, the arrangements shown in Figure 6 or Figure 7 of CISPR 18-2:2017 may be incorporated into the test circuit of Figure 5.

The test circuit shall be arranged so as to permit an accurate measurement of the radio noise level generated by the object under test. Any interference from outside the test circuit, including the supply, or from other parts of the circuit, shall be at a low level and, preferably, at least 10 dB below the level specified for the test object. Also, with the specified test voltage applied to the circuit, the level of background noise shall be at least 6 dB below the lowest level to be measured (see 4.5.11 – CISPR 18-2:2017). **5**

## 8 Requirements for test voltage

RI measurements shall be made with a power-frequency voltage (for AC insulators) or direct voltage (for DC insulators) applied to the test object. The test voltage and its method of measurement shall comply with the requirements of IEC 60060-1. ~~The radio noise level produced by the connections between the transformer and test insulator shall be insignificant compared with the levels to be measured from the test object at the test voltage.~~

## 9 Atmospheric conditions

The standard reference atmospheric conditions in accordance with IEC 60060-1 are not applicable to radio interference tests.

Tests made in accordance with this document shall be performed under atmospheric conditions complying with the following requirements:

- temperature between 10 °C and 35 °C
- pressure between 87 kPa and 107 kPa (870 mbar and 1 070 mbar)
- relative humidity between 45 % and 75 %.

~~NOTE 1~~ The absolute humidity and the atmospheric pressure can influence the test results.

~~NOTE 2~~ By agreement between the purchaser and manufacturer, e.g. to simulate service conditions, tests may be carried out under other atmospheric conditions. Examples of these include:

- temperature between 5 °C and 40 °C
- relative humidity between 20 % and 80 %.

Correction to standard atmospheric conditions shall not be applied to either the test voltage or the radio interference measurements.

The atmospheric conditions shall be recorded.

## 10 Test area

Tests on smaller insulators and insulator sets preferably shall be performed inside a screened room which is large enough to prevent the walls and floor having any significant effect on the distribution of the electric field at the surface of the test object. Circuits, for example power and lighting, entering the screened test area shall, ideally, be filtered so as to avoid the introduction of radio noise present in the general environment.

When, for testing larger insulators and insulator sets, a suitable screened room is not available, the tests may be carried out at any place where the background noise level is sufficiently low compared with the levels to be measured (see Clause 7).

## 11 Arrangements of insulators for test

### 11.1 Mounting of insulators

Insulators, including bushings, shall, when mounted for radio interference tests, be complete with ~~any~~ all stress control devices and fittings specified by the manufacturer or the purchaser. They shall be mounted either in a standard method of mounting for electrical tests or in a manner simulating service conditions.

Test results are influenced not only by the insulators, but also by the method of mounting and the presence of arcing horns, grading rings, conductor bundles and their position relative to the insulators. Hence a test configuration simulating service conditions shall be as representative as possible.

NOTE 1 Although measurements of the RI characteristics of an insulator are related to its service voltage, the standard methods of mounting are referenced to the requirements or otherwise, to switching impulse tests, since RI measurements are usually made on insulators and insulator sets when they are mounted for other electrical tests, and service voltage is not normally a specified characteristic of an insulator.

Pin insulators, line post insulators and string insulator units shall be mounted in accordance with the standard method of mounting given in the relevant clauses of IEC 60383-1.

~~NOTE~~ For pin and line post insulators, care should be taken to ensure that the high-voltage connection is sufficiently secure to make a good contact with the ~~porcelain~~ ceramic or glass or with the metal end fittings, thus ensuring freedom from local discharges.

Insulator sets for which switching impulse tests are not required shall be mounted in accordance with the standard method of mounting given in the relevant clauses of IEC 60383-2. The mounting arrangement for string insulator units may be applied for short suspension or tension composite insulators (Length ≤ 0,6m). In case of tests in screened rooms the conductor can be omitted. **6**

Post insulators for which switching impulse tests are not required shall be mounted in accordance with the standard method of mounting given in 4.4.1 of IEC 60168:1994.

Bushings for which switching impulse tests are not required shall be mounted in accordance with the standard method of mounting given in 7.3 of IEC 60137:2017.

Insulator sets, post insulators and bushings for which switching impulse tests are required shall:

- either be mounted in accordance with the standard method of mounting given in the relevant clauses of IEC 60383-2, IEC 60168 or IEC 60137.
- or be mounted in a manner simulating the service conditions. In this case 12.3 of IEC 60383-2:1993 or 4.4.3 of IEC 60168:1994 shall apply, as appropriate.

For both methods of mounting care shall be taken to avoid discharges from the high-voltage conductor assembly.

The ends of the assembly shall be protected by suitable corona-free terminations.

Composite station post and composite hollow core station post insulators shall be mounted in accordance with the standard method of mounting given in the relevant clauses of IEC 62231.

Hybrid insulators shall be mounted, depending on type and application, in accordance with IEC 606168, IEC 60383-1, IEC 60383-2 or IEC 62155 for the respective kind of products. **7**

## 11.2 Conditions of insulators before test

Before commencing the radio interference tests the insulators shall be in thermal equilibrium with the test area to avoid any condensation on their surfaces. The surface of the insulation part shall be clean and dry before starting high-voltage tests. ~~When the insulators to be tested are in a clean and dry state,~~ They may be wiped with a dry cloth to remove dust and fibres which might affect the surfaces.

## 11.3 Checking and calibration of test circuit

Before commencing the RI tests the test circuit shall, if necessary, be checked and calibrated in accordance with 4.5.11 and 4.5.12 of CISPR 18-2:2017.

# 12 Insulators for Type test

## 12.1 Number of insulators **8**

Unless otherwise agreed between the purchaser and manufacturer, the number of insulators, ~~excluding string insulator units,~~ subjected to a radio interference test shall be that mentioned in the relevant IEC standard. If no mention is made, then the number of insulators shall be the same as the number specified for the electrical type test in the relevant IEC standard. This requirement is summarized as follows:

- ~~— bushings — 1~~
- ~~— composite insulators — 1~~
- ~~— line post insulators  $H \leq 600 \text{ mm}$  3~~
- ~~— line post insulators  $H > 600 \text{ mm}$  1~~